Notebook, N-02-04-18.2

XE-172 N-02-04-18.1

35
13
105
35
45 20
91 0

13
20
260

Aluminum ✓
Boron ✓
Silicon ✓
Cobalt ✓
Nickel ✓
Magnesium ✓
Antimony ✓
Bismuth ✓
Chromium ✓
Lead ✓
Iron ✓
Zinc ✓
Cadmium
Manganese
Copper ✓
Tin
Phosphorous
Sulphur
Molybdenum
Sodium
Tellurium
tungsten ✓

Selenium
Uranium
Thorium
Zirconium
Cerium
Titanium
Lithium
Arsenic
Silver ✓
Niobium
Vanadium
Didymium
Tantalum
Yttrium

April 18 1902

Alloys for Thermo & other expmts

Tungsten	19	aluminium	1
	18		2
	17		3
	16		4
	15		5
	14		6
	13		7
	12		8
	11		9
	10		10 —
	9		11 —
	8		12 —
	7		13 —
	6		14 —
	5		15 —
	4		16 — 1726
	3		17 — 1866
	2		18 — 1934
	1		19 — 1938

Apr 30 tried W10 Al10 used cryolite as a flux for Al. used a high heat. On opening crus found only a black mass with bright yellow crystals

scattered through it served some of the crystals
Tried same alloy again ~~did not get a b~~ with less heat. The alloy produced was not homogeneous so will ~~not~~ make only those with more Al than 50%

Tungsten	Boron
19	1
18	2
17	3
16	4
15	5
14	6
13	7
12	8
11	9
10	10
9	11
8	12
7	13
6	14
5	15
4	16
3	17
2	18
1	19

Tungsten	Silicon
19	1
18	2
17	3
16	4
15	5
14	6
13	7
12	8
11	9
10	10
9	11
8	12
7	13
6	14
5	15
4	16
3	17
2	18
1	19

May 6

Tungsten		Cobalt
19		1
18		2
17		3
16		4
15		5
14		6
13		7
12		8
11		9
10		10
9		11
8		12
7		13
6		14
5		15
4		16
3		17
2		18
1		19

Complete. May 6

Started Apr 28. Finished Apr 29 10:00 with alloy AM

Tungsten,	19	Nickel 1	— 14.70
	18	2	— 15.5
	17	3	— 17.98
	16	4	— 16.81
	15	5	— 17.69
	14	6	— 18.45
	13	7	— 18.74
	12	8	— 18.71
	11	9	— 18.70
	10	10	— 18.13
	9	11	— 18.85
	8	12	— 18.69
	7	13	— 18.98
	6	14	— 19.53
	5	15	— 18.65
	4	16	— 19.20
	3	17	— 19.38
	2	18	— 19.79
	1	19	— 19.8

Made W14 Ni6 W10 Ni10 + W6 Ni14 first then started a beginning of series

I was impossible to fuse the first two alloys of the series you could see the Ni melt + be absorbed by the W. By using about 95 amperes for

OVER

(4)

about five minutes the W would become a thick pasty mass but not a clear fusion although the lime of the cruc was softened so much that it was found to be crystalline on cooling.

Alloys containing 30 % + over of Ni melt much more easily + completely + make nice buttons

Tungsten	Magnesium
19	1
18	2
17	3
16	4
15	5
14	6
13	7
12	8
11	9
10	10
9	11
8	12
7	13
6	14
5	15
4	16
3	17
2	18
1	19

apr 29

Tungsten	Antimony
19	1
18	2
17	3
16	4
15	5
14	6
13	7
12	8
11	9
10	10 —
9	11
8	12
7	13
6	14
5	15
4	16
3	17
2	18
1	19

Sb is all volatilized out.
Same as Bi

Started Apr 29 10.00 A.M.

Tungsten	Bismuth
19	1
18	2 —
17	3
16	4
15	5
14	6 —
13	7
12	8
11	9
10	10 —
9	11
8	12
7	13
6	14 —
5	15
4	16
3	17
2	18
1	19

It is impossible to completely fuse the W it only gets slightly pasty + sticks together nicely when the Bi is thrown. The heat is sufficient to completely volatilize Bi when less than ~~1 of~~ 10 g of Bi are used when more than this amount of Bi is used some remains

fact it does not appear to have combined with the W at all

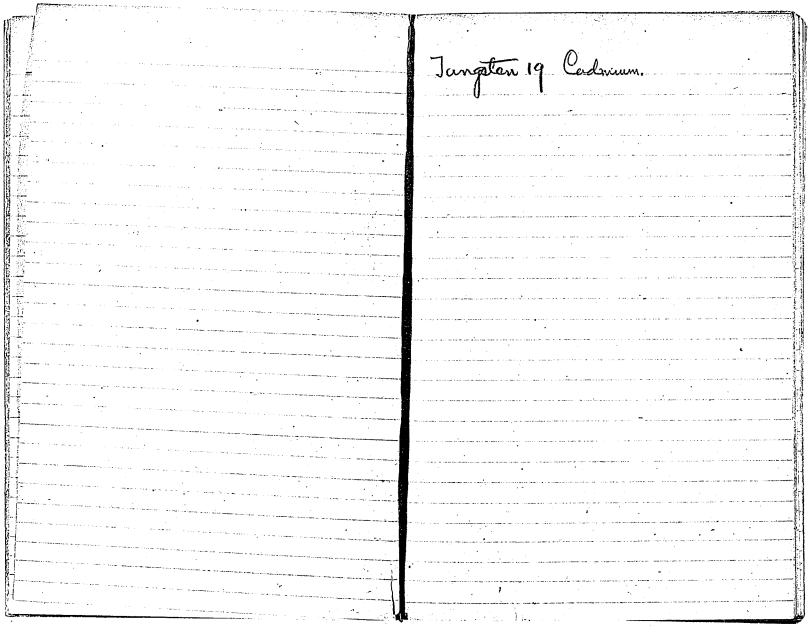
May 13 *

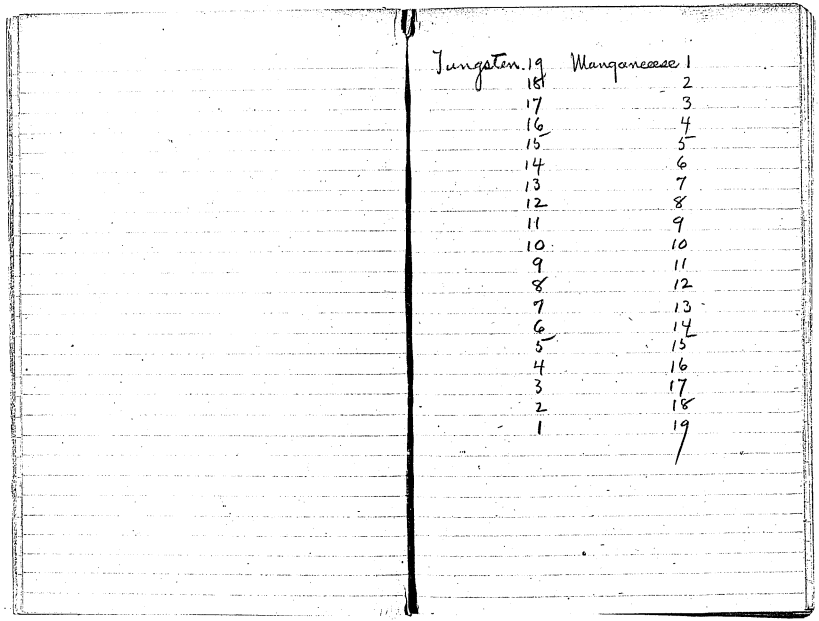
Tungsten	Lead
19	1
18	2
17	3
16	4
15	5 ——
14	6 ——
13	7
12	8
11	9
10	10 ——
9	11
8	12
7	13
6	14
5	15
4	16
3	17
2	18
1	19

The Pb above will seem to alloy with the W. The W does not melt in the furnace it remains as a porous mass which simply wicks up the Pb noticed this in W 10 Pb 10 where the W sucked up 4 g. of Pb + the remainder of the Pb was

left in globules sticking to it
when I squeezed the button with
the pincers more lead came
out of it in globules

Tungsten	Zinc
19	1
18	2
17	3
16	4
15	5
14	6
13	7
12	8
11	9
10	10
9	11
8	12
7	13
6	14
5	15
4	16
3	17
2	18
1	19


Tungsten 19 Cadmium.


Tungsten. 19
18
17
16
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14
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1
Manganeeeee 1
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3
4
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15
16
17
18
19

Apr 29 Finished Apr 30 11 P.M.

Tungsten	Copper	
19	1	15.7
18	2	
17	3	
16	4	17.61
15	5	18.58
14	6	18.3
13	7	17.
12	8	15.75
11	9	16.05
10	10	16.93
9	11	17.99
8	12	17.9
7	13	17.65
6	14	19.24
5	15	17.0
4	16	15.
3	17	18.63
2	18	19.68
1	19	

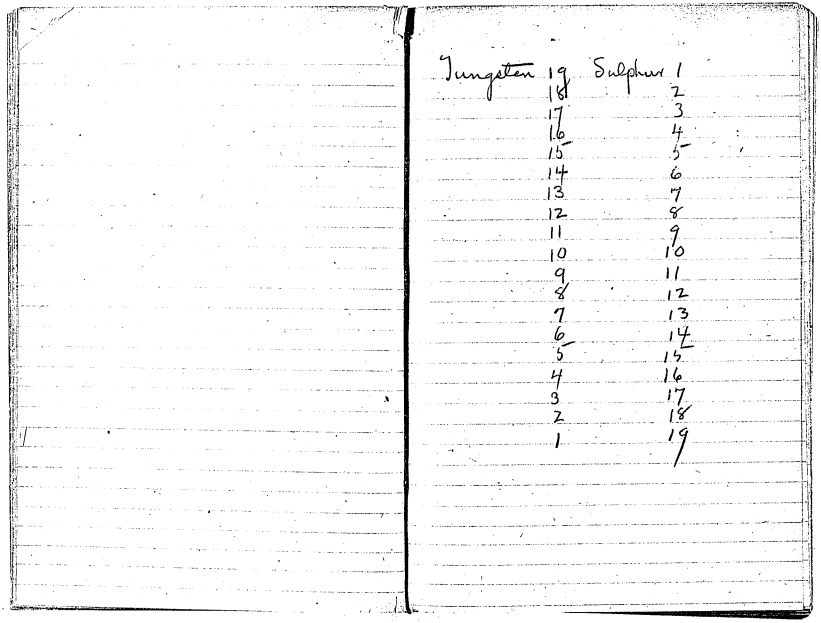
alloys with less than about 5% Cu do not seem to be homogeneous there appears to be an alloy in the center surrounded by an compound W. ~~Cu~~ probably due to incomplete fusion I am making alloy W10 Cu10

I noticed that the W melted + became very fluid at first, commenced to combine with the W + became thicker as it took up more W + could not be brought again into a fluid state even with prolonged heating with 90 amperes.

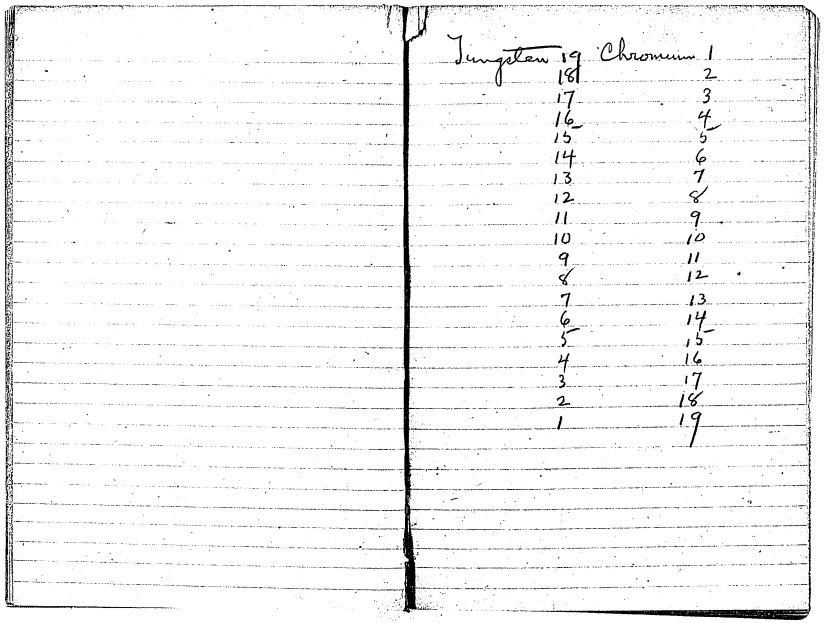
Jupiter,	Jim
19	1
18	2
17	3
16	4
15	5
14	6
13	7
12	8
11	9
10	10
9	11
8	12
7	13
6	14
5	15
4	16
3	17
2	18
1	19

May 13

Tungsten	Phosphorous
19	1
18	2
17	3
16	4
15	5
14	6
13	7
12	8
11	9
10	10
9	11
8	12
7	13
6	14
5	15
4	16
3	17
2	18
1	19


Tungsten 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
Sulphur 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

Tungsten		Molybdenum
19		1
18		2
17		3
16		4
15		5
14		6
13		7
12		8
11		9
10		10
9		11
8		12
7		13
6		14
5		15
4		16
3		17
2		18
1		19


Tungsten 19
18
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11
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9
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7
6
5
4
3
2
1
Chromium 1
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3
4
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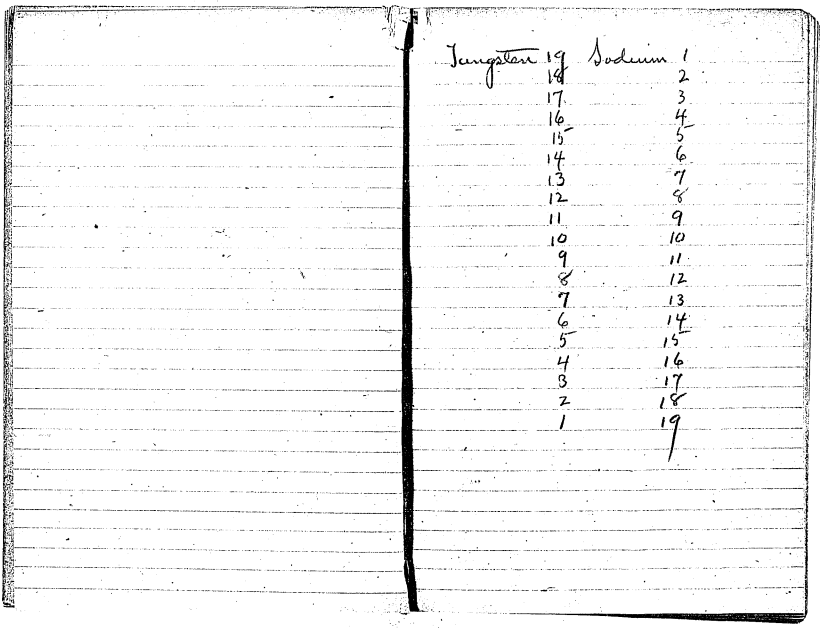
19


Tungsten 19
18
17
16
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14
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11
10
9
8
7
6
5
4
3
2
1
Sodium 1
2
3
4
5
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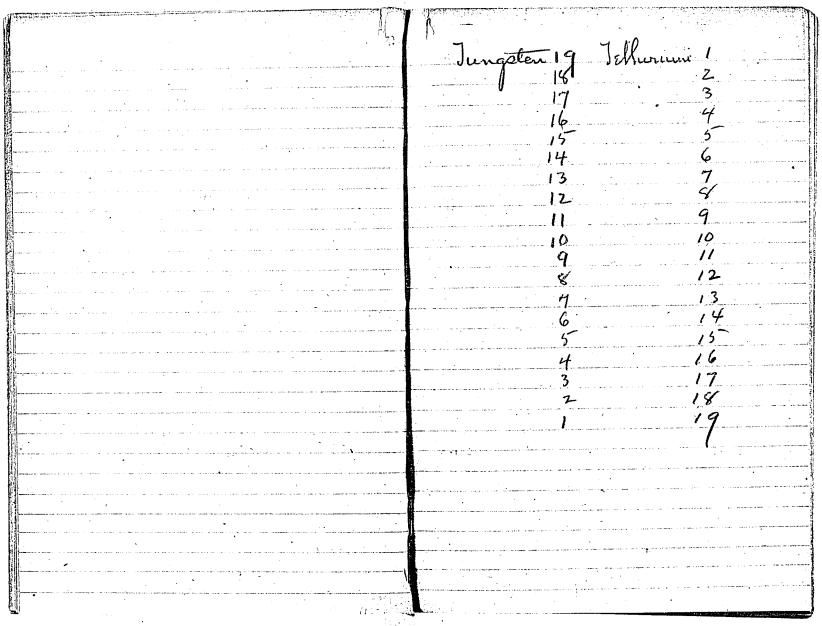
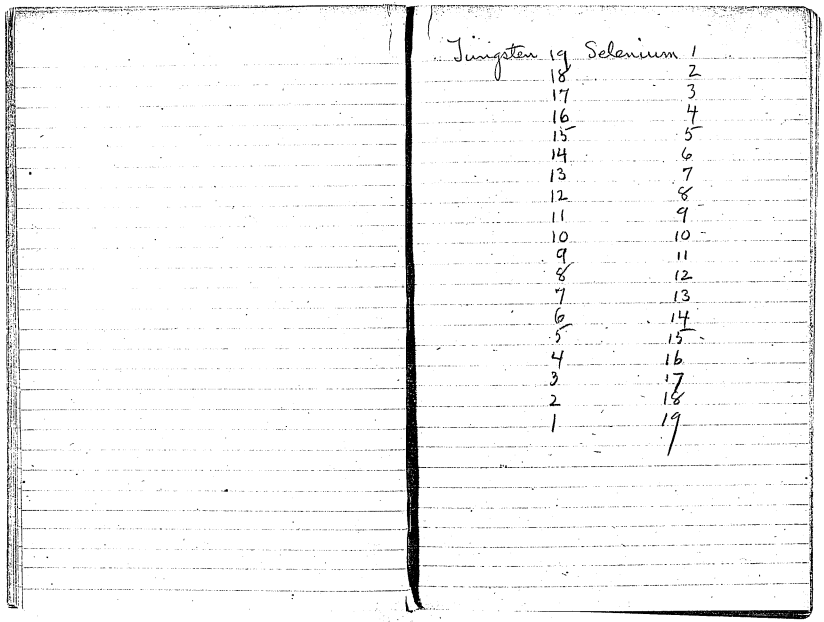
16
17
18
19



Tungsten 19	Tellurium 1
18	2
17	3
16	4
15	5
14	6
13	7
12	8
11	9
10	10
9	11
8	12
7	13
6	14
5	15
4	16
3	17
2	18
1	19


Tungsten 19
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5
4
3
2
1
Selenium 1
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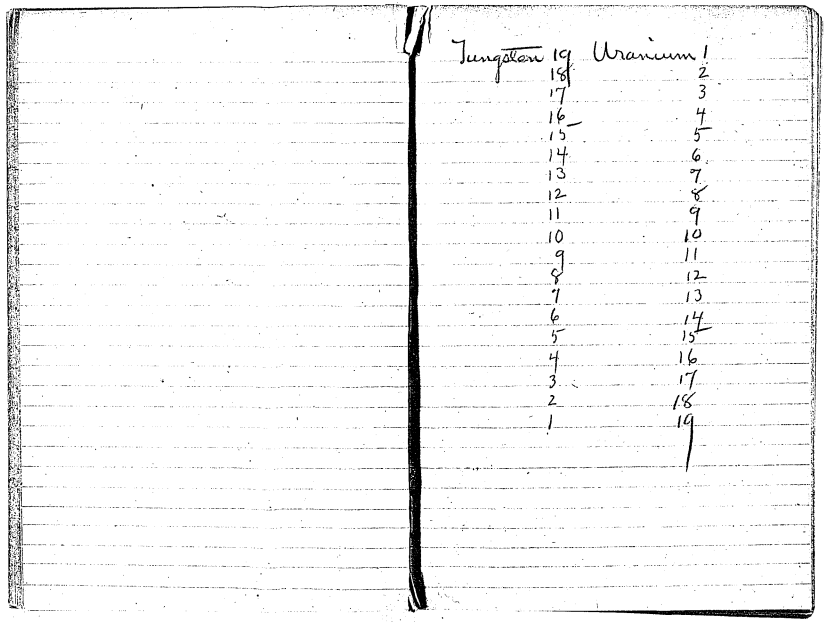
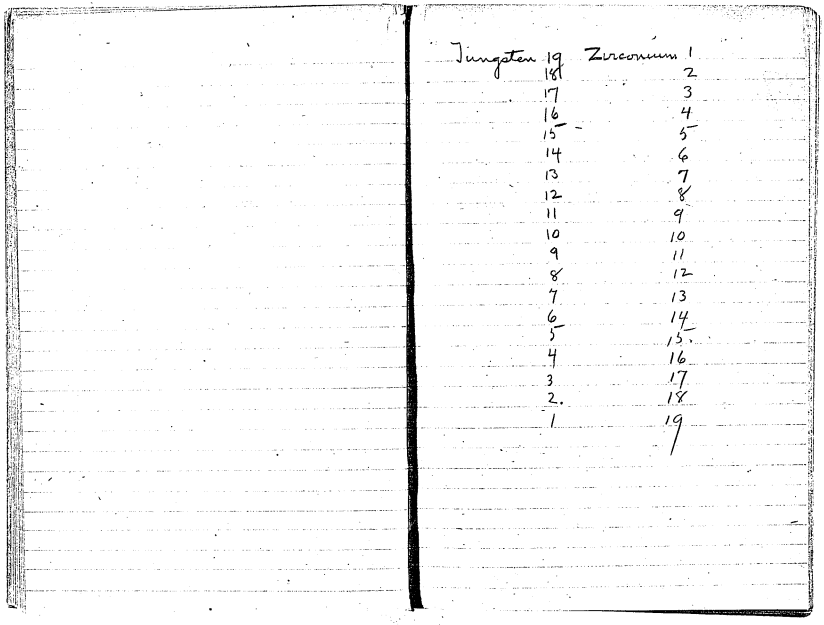
19


Tungsten 19 Uranium 1
18 2
17 3
16 4
15 5
14 6
13 7
12 8
11 9
10 10
9 11
8 12
7 13
6 14
5 15
4 16
3 17
2 18
1 19

Tungsten	Thorium
19	1
18	2
17	3
16	4
15	5
14	6
13	7
12	8
11	9
10	10
9	11
8	12
7	13
6	14
5	15
4	16
3	17
2	18
1	19


Jungaten 19
18
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5
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3
2.
1
Zirconium 1
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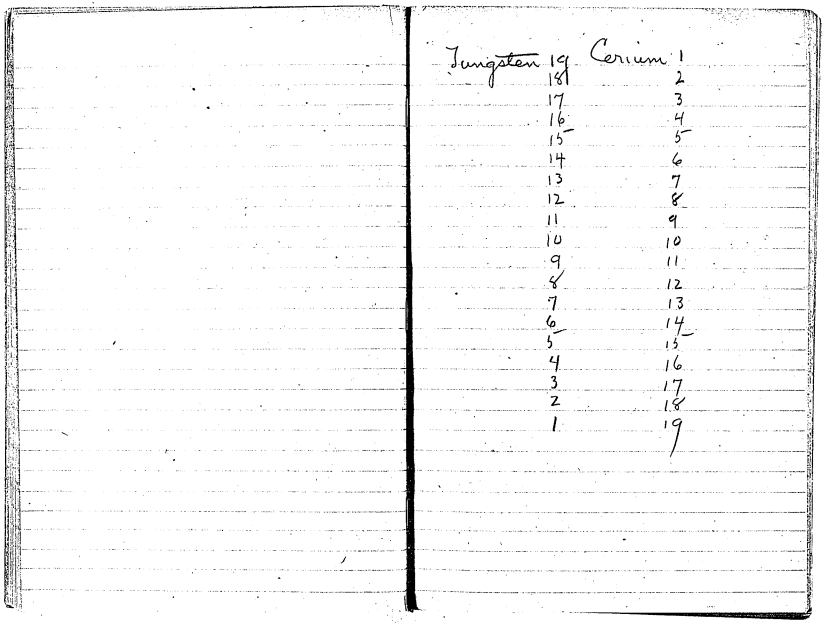
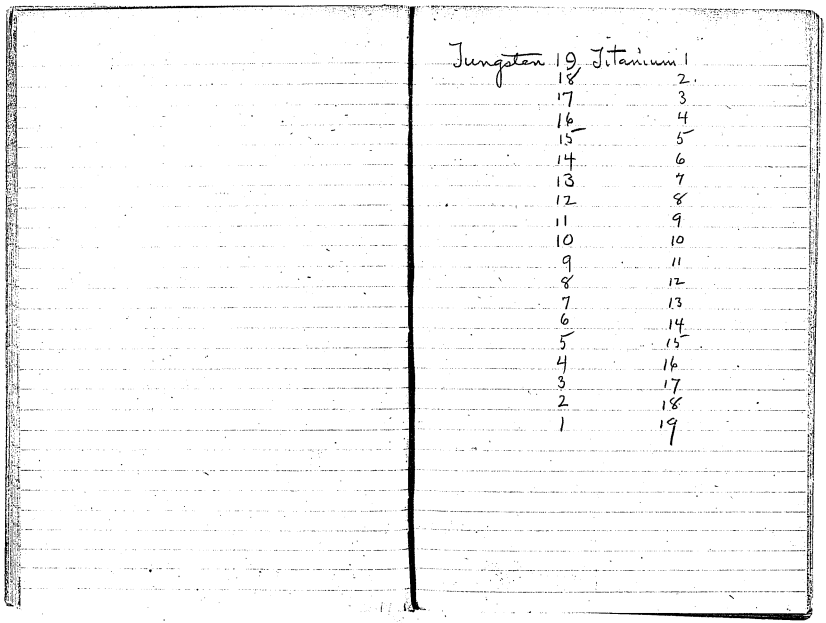
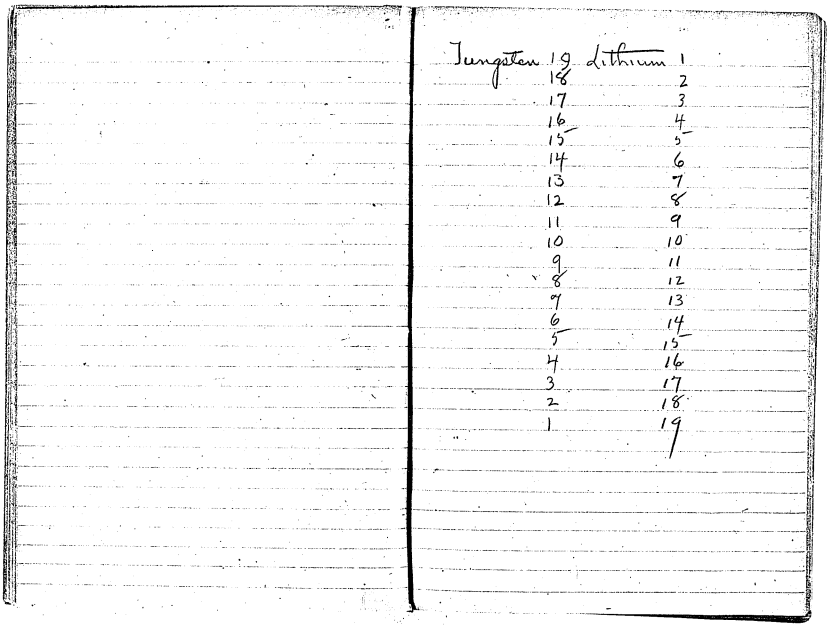
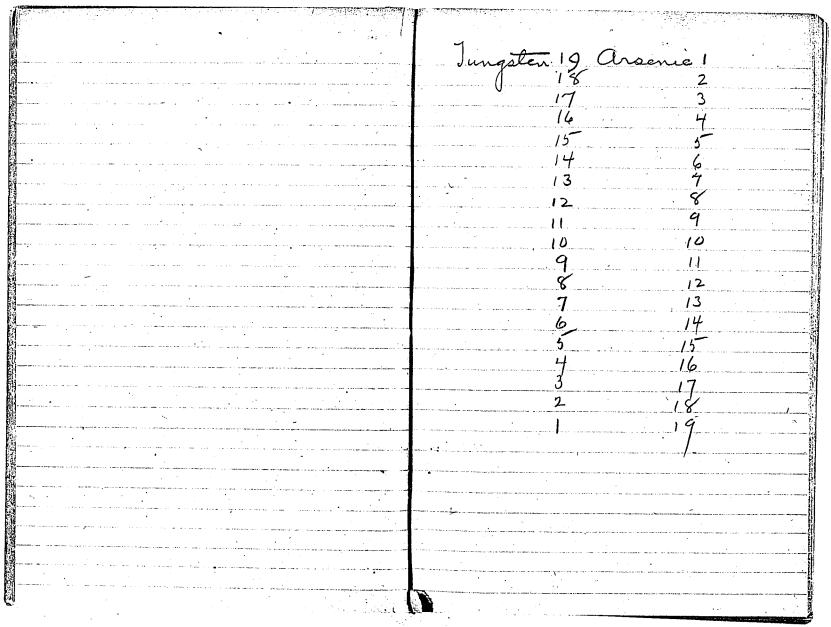
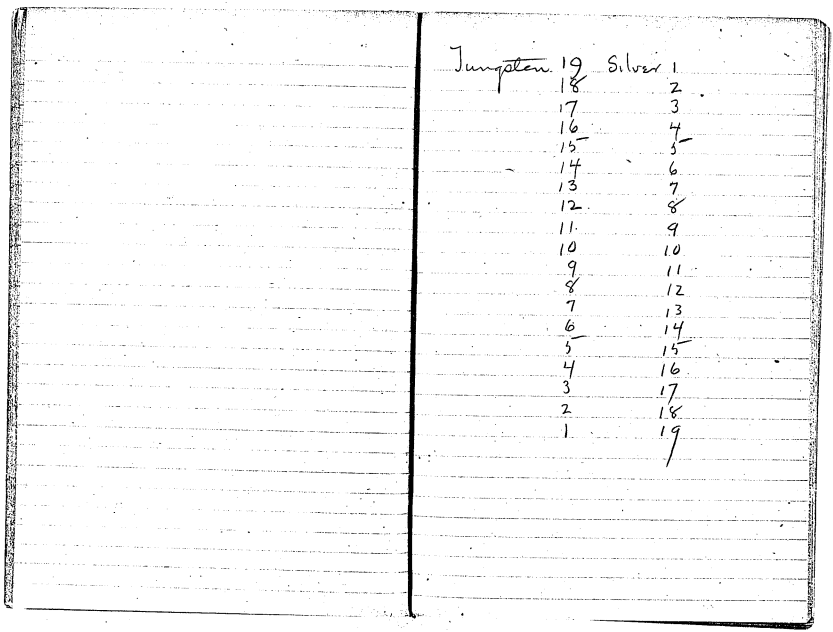

Tungsten 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
Cerium 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19


Tungsten 19 Titanium 1
18 2
17 3
16 4
15 5
14 6
13 7
12 8
11 9
10 10
9 11
8 12
7 13
6 14
5 15
4 16
3 17
2 18
1 19


Tungsten 19 Lithium 1
18 2
17 3
16 4
15 5
14 6
13 7
12 8
11 9
10 10
9 11
8 12
7 13
6 14
5 15
4 16
3 17
2 18
1 19


Tungsten 19 Arsenic 1
18 2
17 3
16 4
15 5
14 6
13 7
12 8
11 9
10 10
9 11
8 12
7 13
6 14
5 15
4 16
3 17
2 18
1 19


Jumpolen 19 Silver 1
18 2
17 3
16 4
15 5
14 6
13 7
12 8
11 9
10 10
9 11
8 12
7 13
6 14
5 15
4 16
3 17
2 18
1 19

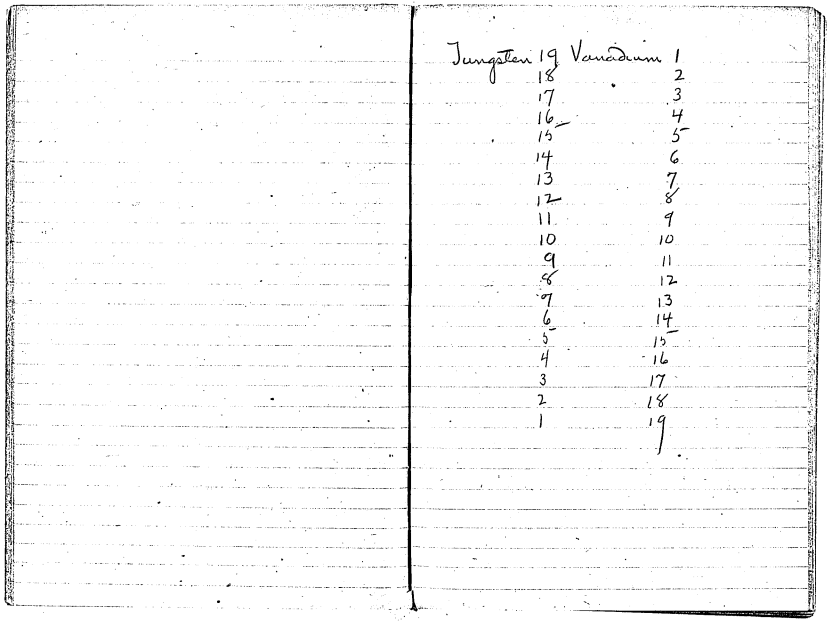
Apr 30

Tungsten	Iron
19	1
18	2
17	3
16	4
15	5
14	6
13	7
12	8
11	9
10	10
9	11
8	12
7	13
6	14
5	15
4	16
3	17
2	18
1	19

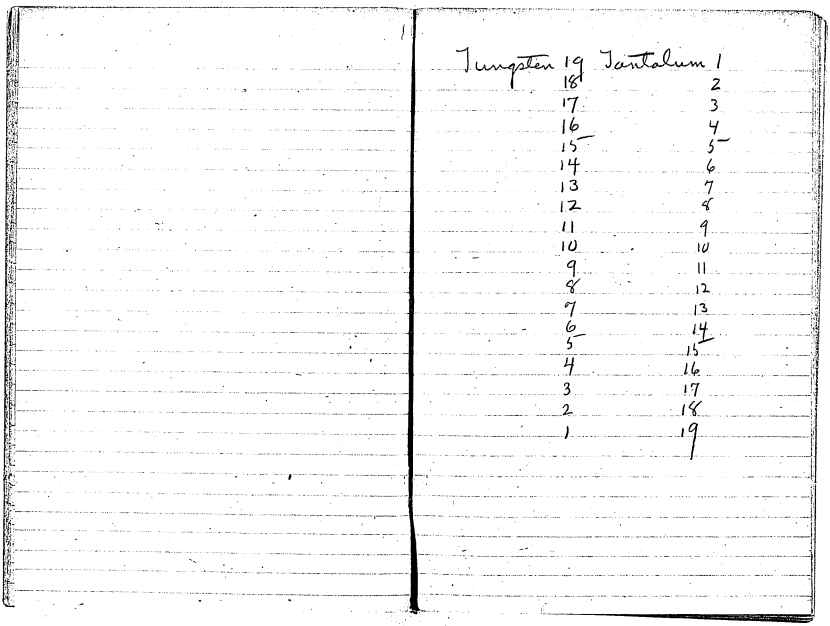
Started on W10 Fe10 Fe fused OK but W did not it seemed to form a pasty mass with Fe + the alloy required ~~[illegible]~~ considerable ~~[illegible]~~ heating before it appeared to be homogenious in the furnace. Next made W6 Fe14 This fused more easily

but made a more porous button perhaps because I didn't use powdered coke ~~& I~~ throwing the coke on the W10 Fe10 alloy caused quite a vigorous reaction which threw some of the alloy out of the furnace so did not use it in ~~[illegible]~~ W6 Fe14

Tungsten	Niobium
19	1
18	2
17	3
16	4
15	5
14	6
13	7
12	8
11	9
10	10
9	11
8	12
7	13
6	14
5	15
4	16
3	17
2	18
1	19


Tungsten 19 Vanadium 1
18 2
17 3
16 4
15 5
14 6
13 7
12 8
11 9
10 10
9 11
8 12
7 13
6 14
5 15
4 16
3 17
2 18
1 19

Tungsten	Ordinyium
18	2
17	3
16	4
15	5
14	6
13	7
12	8
11	9
10	10
9	11
8	12
7	13
6	14
5	15
4	16
3	17
2	18
1	19


Tungsten 19
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3
2
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Tantalum 1
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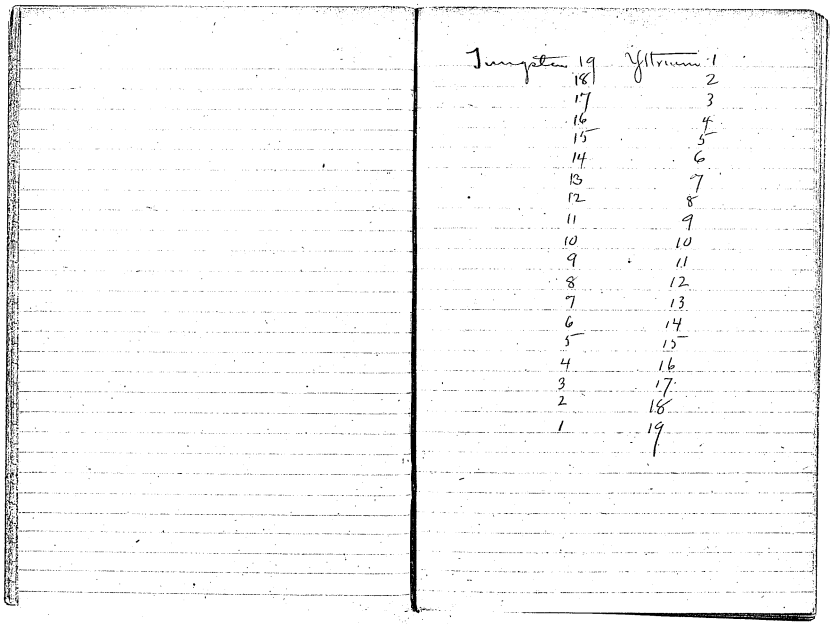
19


Jungsten 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
Yttrium 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19